MODELS & SIMULATIONS 7

Barcelona, May 18-20, 2016.

Faculty of Philosophy, Universitat de Barcelona. c/ Montalegre 6, 4th floor.

www.ub.edu/ms7

BOOK OF ABSTRACTS

*Abstracts are listed in alphabetical order.

Patrick Allo. *A Data-Structure Metaphor for Visualisation.*

In this talk I want to extend insights on modelling from the method of abstraction with a data-structure metaphor, and use this to reconnect the computational and data-driven focus from the fields of scientific visualisation, information visualisation and visual analytics with the epistemological and inferential concerns that are central to how visualisation (and modelling in general) is conceptualised within the philosophy of science.

Sorin Bangu. *Anderson's Constructionism: the Case of the BCS Superconductivity Model.*

In *More is Different*, P. W. Anderson signals the "fallacy" that reductionism entails 'constructionism'– ie, that "the ability to reduce everything to simple fundamental laws" implies "the ability to start from those laws and reconstruct the universe." In this talk, I look closely at one major achievement of condensed matter physics mentioned, but not examined, in his paper –the modeling of (type I) superconductivity, by Bardeen, Cooper and Schrieffer. I ask whether (or not) the BCS model illustrates his thesis. Central to my discussion is an analysis of the genealogy of a novel physical construct, the 'Cooper pair'.

Anouk Barberousse and Julie Jebeile. *Climate Models: Still Uncertain, Yet Improved.*

Improvements in terms of computer power and process understanding are continuous in climate science. They are expected to reduce the uncertainty affecting model predictions and projections. A way to assess such reduction is to estimate model spread, which measures the range of estimates from multiple models. Decrease in uncertainty is expected to result in a decrease in model spread. However models in successive Intergovernmental Panel on Climate Change reports do not manifest any reduction in model spread. Does it mean there has been no model improvement resulting in decrease in uncertainty? Our aim is to explain this seemingly paradoxical situation.

Eva Boon. *Darwinizing Culture: What Models of Biological Evolution are Appropriate for Analyzing Cultural Data?*

Cultural evolution proposes to study change in cultural traits analogous to biological evolution. Models and methods from evolutionary biology have been applied to anthropology, archaeology and linguistics. A prominent example is the phylogenetic method, which tests evolutionary hypotheses on a tree-like model of vertical transmission. Theoretical and empirical arguments indicate that the effects of horizontal transmission may violate the assumptions of this model. Here we apply a robustness analysis on a landmark simulation study (Greenhill 2009) to investigate the sensitivity of cultural phylogenies to horizontal transmission and propose network-based methods as an alternative approach.

Sebastian Cacean. *Justifying Serious Possibilities with Unrealistic Models.*

State-of-the-art models are not able to provide probabilistic long-term predictions of complex real world systems such as the climate system. At best their results can be interpreted as serious possibilities. However, since their incorporation of contrary-to-fact assumptions, it is difficult to explicate how they can justify serious possibilities. Using the DDI-account of Hughes (1997), I formulate a solution to meet this possibilistic challenge and argue that unrealistic models can justify serious possibilities, if their empirical adequacy is seriously possible. Additionally, I compare this solution to another suggestion by Betz (2015) and argue that it carries less ontological commitments about models.

Simon Carrignon, Alessandro Mosca, Bernardo Rondelli and José Remesal. *Computer Modelling and Simulation as Heuristic Tool to Understand the Past: the Case of the EPNEt Project.*

In this paper, we argue that formal modelling and computer simulation are valuable tools to overcome limitations made by the incompleteness and the uncertainty of the historical and archaeological record. We first show how evolutionary biologists have successfully embraced this approach and why their work is close to what archaeologists and historians do; we then defend how those models and simulations are a good heuristic tools in science in general and we finished by introducing an interdisciplinary research setting, where the previous points can be exploited in a meaningful way to investigate historical questions.

Annamaria Carusi. *Models as Equivalence Makers: the Example of Computational Biomedicine.*

The paper proposes the conceptual framework of the model-simulation-experiment system (MSE-system) co-developed in a philosophy-science collaboration specifically for computational biology and biomedicine. An MSE-system is a hybrid biological, mathematical and computational entity interweaving experimental data, equations, simulation software and hardware, etc. It suggests a coherentist epistemology, rather than the correspondence epistemology that is most often associated with representationalism. The paper focuses on the tension between the systems view and the tenacity of representationalism, and proposes that models are neither representations nor tools but equivalence-makers.

Alejandro Cassini. *De-Idealized Models*.

I will elucidate the concept of idealization by means of the concepts of abstraction and distortion. I assume that every scientific model is at the same time abstract and distorted to some degree. I claim that any model is susceptible of being de-idealized by removing some distortions and by adding new variables and parameters. I explore some virtues of de-idealization, such as explanatory depth and enhanced predictive power. I also mention some limitations of de-idealization, such as computational tractability and useless accuracy. I conclude that the process of de-idealization is grounded on pragmatic reasons that are not truth-conductive.

Deniz Ceylan and Aziz F. Zambak. *Knowledge Representation in Biological Computational Models: A Category Theoretic Approach to Models and Simulations in Biological Systems.*

This paper aims at showing that modern computational techniques used in biology are depending on certain types of knowledge representation models which are based on set theoretic principles. We defend the idea that we need a mathematical ontology, depending on the category theory, in order to overcome the real challenge for knowledge representation. I will propose GISONT (Global Inference System Ontology) as a mathematical ontology for a proper knowledge representation model that can be used in biological computational models.

Christian Dieckhoff. *Epistemic Meta-Analysis – A Conceptual Proposal for the Analysis and the Comparison of Scenarios.*

Model-based scenarios are an important fundament of decision-making in a number of fields, e. g. in the energy transformation. In reaction to the large number of scenarios published and to their heterogeneity, meta-analyses are conducted to compare the scenarios and to infer conclusions relevant for political decision-making. Thereby, it is assumed that the scenarios lie in a common possibility space. This assumption is not trivially true – and seems to be violated in many cases. Therefore, based on the interpretation of epistemic modalities, I propose the Epistemic Meta-Analysis as a concept to explicitly incorporate the scenarios' underlying knowledge into meta-analyses.

Alkistis Elliott-Graves. *The Danger of Overgeneralization in Ecological Modeling.*

The received view in ecological modeling is that scientists should strive to construct simple models, which aim at subsuming many disparate phenomena and at providing general explanations. Ecologists, especially in fields such as community ecology and invasion biology, have been criticized for not being able to provide these types of generalizations. I argue that this focus on generalization is problematic, as the complex and heterogeneous nature of ecological systems leads to a strong tradeoff between generality and realism. As realism is necessary for detailed explanations and successful predictions of a phenomenon, opting for generality at all costs is often counterproductive.

Frank Faries. *Mental Representations as Idealizations in Cognitive Modeling.*

Given the 1) complexity of the brain, 2) current computational limits, 3) the history from which they are descended, and 4) the purposes for which they are employed, mental representations are best conceived as idealizations in cognitive modeling. If we employ any of the standard approaches of "idealization checking" advanced by Weisberg (2007), Strevens (2004), we see that mental representations do not survive. If we adopt a positive view of idealizations' contribution to representation, we may keep using mental representations in cognitive modeling and see their persistence as justified, even if they are not accurate of the world.

Matthieu Gallais. *Fictional Models and Target Systems: Unauthorized Games of Make-Believe and Similarities Between Properties.*

According to Roman Frigg, scientific models are similar to fictions because they are considered as props in authorized games of make-believe. However, within the theory of fiction developed by Kendall Walton, other games are based on ad hoc props. I suggest that both kinds of games intervene in science. Especially, I argue that ascribing idealized properties to concrete objects is an unauthorized game. Strictly speaking, the extension of an idealized property contains fictional entities only. But the notion of world-line that Jaakko Hintikka developed in connection with modal semantics will help explain how idealized and concrete properties are related.

Pierre-Luc Germain. *Concrete Biological Models: Beyond a Dyadic and Surrogative View of Modelling.*

This contribution examines the functioning of concrete biological models, i.e. biological systems such as an animal or a tissue culture used to learn about another system. Focusing particularly on the interplay between in vitro and in vivo models, I argue against a dyadic and surrogacy view of modeling, and show that models generally do not relate to their target in autonomous ways. I characterize a distributed form of modeling that differs in important respects from multiple-model idealization or classical triangulation, and show the conceptual and material practices underpinning it, suggesting a different philosophical outlook on modeling.

Matti Heinonen. *Modeling Purposive Agency: a Neo-Gricean Approach.*

H.P. Grice (1974-5) suggested model-construction as an alternative to conceptual analysis as a research strategy in the philosophy of mind and action. Unfortunately, Grice did not develop this proposal into a systematic methodological framework, or connect it to model-based approaches in other areas of philosophy. My paper expands upon Grice's proposal in order to defend model-construction as a feasible methodological approach in the philosophy of action, with an emphasis on debates that pertain to the nature of group agency, in particular.

Paul Humphreys. *Topic Models as an Example of Computer Modeling in the Humanities.*

Philosophers of science naturally identify models with scientific models, but the humanities also use models, especially in the digital humanities. Because philosophy has been slow to adopt these methods, there is little explicit philosophical analysis of the methodological advantages and disadvantages associated with these supervised and unsupervised computational methods. In this talk, I shall provide results from my research applied to a canonical philosophical text, John Stuart Mill's A System of Logic and discuss the epistemological benefits and flaws of one specific modeling technique – topic modeling – which is one of the most widely used tools for textual analysis.

Koray Karaca. *Modeling Data Acquisition at the Large Hadron Collider: Against the Hierarchy of Models in High Energy Physics Experiments.*

I examine the ATLAS experiment at the Large Hadron Collider as a case study to illustrate that in order to acquire data from the detector outputs, a model of data-acquisition is used in present day high-energy physics experiments. I point out that the main function of a data-acquisition model is to ensure that data-selection is performed in such a way as to yield data that are appropriate for the intended objectives of the experiment. Furthermore, I argue that the relation between theoretical models and procedures of data-acquisition is a direct one that does not involve any intermediary of other models.

Ismo Koponen and Maija Nousiainen. *Computational Modelling in Educational Research: Do We Need Such an Approach?*

Prospects for modelling the social and cognitive aspects of the learning-teaching process in science education is discussed. Cognitive aspects of learning are modelled as probabilistic exploration of epistemic landscape, guided by dynamic model of cognitive development. The social interaction of the agents is described by probabilistic opinion dynamics and it affects the exploration process through direct process of social conformity of opinion. It is suggested -- contrary to views that computational modelling may distort how the phenomena of learning and teaching are conceived and conceptualized – that the modelling may instead clarify the conceptualisation, rationalisation and reasoning about these phenomena.

Jaakko Kuorikoski and Aki Lehtinen. *DSGE and Ad Hocness.*

Macroeconomic DSGE models are widely criticized for their problematic structural assumptions, empirical shortcomings, and their liberal use of ad hoc assumptions and parameter values. We explore the way in which DSGE models are used in academic economic research as well as in more policy-oriented research in a central bank setting. We argue that such models work more like platforms for integrating expert judgements rather than according to the standard understanding of theoretical models in philosophy of science. We distinguish between three kinds of ad hocness and argue that ad hocness should be evaluated in relation to this epistemic role.

Juergen Landes, Barbara Osimani and Roland Poellinger. *Modeling and simulating epistemic dynamics in pharmaceutical harm assessment.*

Current methods for evidence amalgamation rely on narrative reviews or data-pooling (meta-analysis), and fall short of providing formally founded ways to justify probabilistic confirmation of causal hypotheses. We propose a system for probabilistic harm assessment, grounded on evidential Bayes nets developed as unifying “inference engines” which accommodate different kinds of evidence and inferential patterns. We present the theoretical foundations of such model and illustrate its epistemic value by simulating hypothetical and real cases in the pharmaceutical setting. Furthermore, we show its methodological advantages by illustrating how to nest causal graphs and evidence derived from computational models in our inferential net.

Insa Lawler. *(How) Do Models Provide Understanding-Why?*

Intuitively, understanding why *p* is factive; it requires believing a correct explanation for why *p*. Yet we seem to gain understanding-why via explanations based on idealized models. I argue that the attempts to resolve this alleged clash by analyzing model-based explanations as how-possibly explanations or as according-to-the-model explanations do not succeed. While being true, such explanations are either not proper explanations for why *p* or do not provide understanding-why, but rather understanding with a model. Instead, I defend the view that the explanatorily crucial propositions of model-based explanations are veridical. The idealized assumptions play roles other than explanatory ones.

Aki Lehtinen and Caterina Marchionni. *The Epistemic Benefits of Generalization in Economic Modelling.*

We try to spell out why generality is an important desideratum in economic modelling. Our notion of generality is based on the comparison of model-components in terms of abstractness. We argue that generalising models serves similar epistemic functions as robustness analysis: it provides a solution to the epistemic uncertainty that arises from the presence of unrealistic assumptions. Generalising models and probing their robustness constitute complementary strategies and that under certain conditions the former may represent a superior strategy. We present our arguments by taking examples from economic modelling.

Carlo Martini and Manuela Fernández Pinto. *Modeling the Social Organization of Science: Chasing Complexity through Simulations.*

The influence of social factors science research has been studied at least since Kuhn. Recently, formal models and computer simulations have allowed philosophers of science and epistemologists to dig deep into the dynamics of what influences research and experimentation, and to develop seemingly realistic models of the social organization of science. These models purport to be predictive of the optimal allocations of factors like diversity of methods, group sizes, and communication channels. We argue that current research faces an empirical challenge: to connect simulation models with data. We present both optimistic and pessimistic scenarios about how the challenge may unfold.

Ioan Muntean. *Fictions, the Future, and Maps in Forecast Models.*

Abstract: This paper discusses the role of fictions in forecast models. We start with the "model fictionalism" (Godfrey-Smith), and work by R. Frigg on t-representations. How different are forecast models from the perspective of model fictionalism? We argue that fictions play a different, albeit important role, in forecast models, based on the restricted access we have to the target space of forecast models. We focus here on the structure of Frigg's target space. We insist on the non-mimetic aspect of fictions in forecast models. We also show that in forecast models two keys are needed for Frigg's t-representations as maps.

James Nguyen. *Scientific Representation is Representation As.*

We propose a novel account, inspired by Nelson Goodman and Catherine Elgin's discussions of representation-as, of in virtue of what scientific models represent their targets. We call this the `DEKI' account. Scientific representation requires: denotation, exemplification, a key, and imputation. Models denote their targets, and exemplify their epistemically salient features. Keys associate these features with those potentially instantiated by target systems. A user then imputes these onto the target, thus using a model to represent a target as thus and so.

François Pellet. *An Ontological Approach to Simulations and Computer Simulations.*

A definition of simulations and computer simulations should encompass both their ontological and epistemological aspects. I focus here on the ontological aspect by answering the question "What is the ontological status of simulations and computer simulations?". First, I argue that "simulation" is an action noun designating an act of representing a target, an intentional dynamic representational relation, a process intentionally representing a target, a dynamic medium of an intentional representing process, and a target intentionally represented by a process. Second, I argue that computer simulations' ontological status is a category of simulations whose dynamic medium is a running hardware machine.

Roland Poellinger and Cameron Beebe. *Bayesian Confirmation by Analogy.*

Analog models are employed to investigate aspects of a target system we might not have easy empirical access to. Analog models have been used to argue for confirmation of a target theory. In contrast to Dardashti et al. (2014) we propose to accommodate confirmation via analog systems in a Bayesian framework. After discussing two cases of analog reasoning (quantum models, biological explanation) we show how these examples cannot be expressed in Bayesian models. We develop an extension of (causal) Bayes nets to encode analogy as symmetric relation and conclude by discussing how this formalization sheds new light onto pre-unificatory explanation.

Samuli Poyhonen. *Topological Explanations in the Social Sciences.*

This paper examines topological explanations occurring in the social sciences. Philippe Hunemann (2010) has argued that topological explanations constitute an important class of non-mechanistic explanations in biology. Similar explanations can also be found in the social sciences, for example in modeling work in done in network theory and computational social science. By building on recent analyses of the relationship between the contrastive-counterfactual account of (causal) explanation and mathematical explanations, I examine the nature of the explanatory contributions of topological explanations, and study how they can be combined with (and how they depend on) explanations by social mechanisms.

Sarita Rosenstock, Cailin O'Connor and Justin Bruner. *In Epistemic Networks, Is Less Connectivity Really More?*

We show that previous results from network epistemology models (Zollman, 2007, 2010; Kummerfeld and Zollman, 2015) are not robust across changes in parameter values. We use these results to argue that this branch of modeling cannot provide prescriptive advice to real world epistemic communities as to what sorts of epistemic networks will be most successful.

Anna-Mari Rusanen. *Explanatory Mechanistic Models and Pragmatic Relevance.*

In this paper the focus is on the question, how to characterize relevance, and especially pragmatic relevance. In the first part, I´ll sketch a general characterization for the notion of relevance, and articulate the ways that the notion of relevance has been understood in the context of mechanistic explanation- In the final part of this paper I will focus on the "fundamental" question: Is pragmatic relevance something that an item, such as a model of a mechanism, has or is something that is ascribed to items and entities by intentional model builders or users for some purposes or goals?

Fiora Salis. *Fictionalism about Theoretical Models and Scientific Representation.*

In this paper I develop a novel fictionalist account of theoretical models as representations drawing on Walton's aesthetic notion of fiction. To this aim I will offer a general definition of models as representation, I will spell out Walton's aesthetic notion of fiction, I will assess current fictionalist accounts of models, and I will finally spell out a novel account in terms of the key notions of propositional imagination and denotation.

Iñaki San Pedro and Andoni Ibarra. *Performative Representing with Computer Simulations.*

Computer simulations can be defined in a 'narrow' sense just as computer routines, in a 'broad' sense as a whole complex process, or alternatively in two steps by defining the term simulation first. We argue that these three notions of computer simulation each correspond to a different type of representational activity. Thus, computer simulations in the narrow sense are identified with representations based on homomorphism. If understood in the broad sense they are associated to less strict notions of representation, e.g. deflationary approaches. Finally, under the 'alternative' reading, computer simulations can be associated with so-called performative representations.

Julia Sanchez-Dorado. *Judgments of Similarity in Modeling Practices.*

Despite some well-known arguments against the role of similarity in representation (Goodman 1972; Suárez 2003; Frigg 2006), I claim that "similarity" is an epistemically fruitful notion that helps us explain the success of scientific models. Nonetheless, I will move away from contemporary proposals that discuss similarity in terms of necessary or sufficient conditions for representation (French 2003), and I will try to advance a more pragmatic approach to the

problem: the judgment of scientists about relevant similarities –and relevant idealizations and distortions- plays a central role in the practices of modelling that produce genuine understanding of the world.

Peter Tan. *Inconsistent Idealizations and the Structure of Scientific Theories.*

This paper accomplishes three things. First, I show that there are different ways for the representations of a "multiple-models idealization" to be mutually inconsistent. Second, I show that some of the ways for multiple models to be inconsistent are such that their inconsistencies are resolvable: in other words, they can in some sense be reasoned away. And lastly, the way these inconsistencies are resolved helps answer, at a more general level, the following familiar question: How (if at all) do families of models comprise scientific theories? I use one general example throughout: molecular and gene network modeling in cell biology.

Paul Teller. *Modeling and Realism, Scientific and Perceptual.*

The world is far too complex for us to model it with complete precision and accuracy. One consequence is that referential realism fails: Our terms do not succeed in attaching to specific referents. Instead our models represent in terms of idealized ontologies as well as idealized properties and relations. All this goes for purported objects of perception as it does for purported theoretical objects so that instrumentalism fails as an alternative to referential realism. All knowledge, perceptual and theoretical, is comprised by inexact, simplified, idealized ways of thinking about a world that is independent of our imperfect representations.

Melissa Vergara-Fernández. *More Models.*

Since the use of models became a relevant issue within the philosophy of science, whether models represent and how have been some of the questions addressed. Although attempts to answer these questions have brought about important insights, I shall argue that the focus on representation, and particularly on the relationship between a model and its target, has obscured important relationships between models. Models do not stand on their own. Here I (i) illustrate some of these relationships and (ii) suggest how a view of models as clusters can shift our assessment with respect to their epistemic import.

Philippe Verreault-Julien. *A Case for non-causal Understanding with Models.*

A recent family of accounts of understanding state that one understands when one is able to answer 'what-if-things-had-been-different' questions. According to them, a crucial constituent of understanding is having knowledge of dependence, especially of causal dependence. Whether modelling can provide knowledge of non-causal dependence has not really been investigated so far. Here I propose such a case of non-causal understanding. More precisely, I argue that the Arrow and Debreu (1954) model of general equilibrium establishes claims of logical dependence and thus affords understanding. Interestingly, that sheds light on a persistent debate concerning the epistemic status of that model.

Nicolas Wüthrich. *The Puzzle of the Persistence of Non-Robust Toy Models.*

There has been growing interest in toy models. In this paper, I identify and dissolve a puzzle regarding a subset of these models: There are toy models which are persistent although their key results are non-robust, they do not display heuristic value for generating new models via de-idealization, and they have a poor predictive track record. Despite this, I argue that these models have epistemic value. The models allow identifying a stylized problem with agenda-setting character for a discipline and they provide an explanatory template for viewing causal processes. I illustrate my claims via Dornbusch's model of the exchange rate.

Karen Yan. *Understanding the Explanatory Power of Dynamical Models in Systems Science*.

Proponents of mechanistic explanation argue that dynamical models in systems science are explanatory if only if they are coordinated with mechanistic models. This idea is encapsulated by Kaplan and Craver's (2011) model-to-mechanism mapping constraint (the 3M constraint). In contrast, Ross (2015) argues that dynamical models can be explanatory without meeting this constraint. Against Kaplan and Craver, I point out a deficiency in the 3M constraint, namely, that it neglects causal relations among the activities of a mechanism. And against Ross, I argue that the dynamical model in her case study is explanatory in a mechanistic sense.